A geo-spatial analysis method to zone California waters

as a foundation to implement ecosystem-based management in the California Current

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Abstract

One of the Ocean Protection Council's (OPC) objectives, as set out in their 5-year Strategic Plan (2006), is to "[D]evelop practical approaches to implementing ecosystem-based management and encourage their implementation throughout the State." An important component of such a management regime is ocean zoning across jurisdictional boundaries. Here, we report on how work done for the Central Coast Marine Life Protection Act process could form a solid foundation from which the OPC can build ecosystem-based management in California waters and beyond.

Our overall approach to identifying the most appropriate management measures for the protection of important ecological areas consists of the following steps:

1. Identify key ecological criteria based on species, food web, and habitat protection goals
2. Gather and analyze datasets to identify features meeting key criteria
3. Identify important ecological areas in the Central Coast study area based on overlapping features in datasets
4. Analyze and subdivide each area in detail based on ecological features
5. Identify potential anthropogenic impacts to identified features to the extent information is available
6. Assign specific management objectives to each sub-area to protect identified ecological features
7. Evaluate the entire network based on each objective

Example

Area	Key ecological features	Potential threats	Management objectives
1 North Año Nuevo	Rocky intertidal Multiple rocky reefs High fish/bird diversity	Commercial fishing Recreational fishing Kelp harvesting Seafloor bottom contact Depletion of forage base	Protect forage base for top predators Protect seafloor and other biogenic habitat
2 West Año Nuevo	Buffer to elephant seal rookery High fish/bird diversity	Commercial fishing Recreational fishing Kelp harvesting Seafloor bottom contact Depletion of forage base	Protect forage base for top predators Protect seafloor and other biogenic habitat
3 Point Año Nuevo	Major elephant seal rookery Seabird colony Upwelling center Nearshore hard substrate High fish/bird diversity Kelp	Commercial fishing Recreational fishing Kelp harvesting Seafloor bottom contact Vessel disturbance Depletion of forage base	Protect seabird/mammal colonies from human disturbance Protect seafloor and other biogenic habitat Protect forage base for top predators Protect benthic invertebrates and groundfish
4 South Año Nuevo to El Jarro Point	Buffer to elephant seal rookery and seabird colony Coastal marshes Nearshore hard substrate Seabird colony High fish/bird diversity	Commercial fishing Recreational fishing Kelp harvesting Seafloor bottom contact Depletion of forage base	Protect seafloor and other biogenic habitat Protect forage base for top predators Protect benthic invertebrates and groundfish

Datasets used

The datasets here, used in our original MLPA communication (October 15 2005), have since been expanded with additional data from the NOAA biogeographic database and other information made available during the essential fish habitat (EFH) process in federal waters.

1. Hard substrate / rocky reefs. (Coarse Scale Habitat and Fine Scale Habitat layers from the IMS site, Zimmerman 2003 database of untrawlable areas)
2. Biogenic habitat (coral and sponge records compiled by the NMFS 2005 Preliminary Report of Occurrences of Habitat-Forming Invertebrates)
3. Canyons and canyonheads (Canyons of Central California data layer from IMS site)
4. Habitat for overfished groundfish (EFH EIS highest 20% Habitat Suitability Indices for NMFS declared overfished groundfish)
5. Nearshore FMP species and abalone habitat (habitat requirements listed in Nearshore FMP and Abalone Recovery Plan)
6. Marine mammal rookeries / haulouts (known elephant seal colonies and marine mammal rookeries and haulout layers from IMS site)
7. Seabird colonies and foraging areas (major seabird colonies data layer from IMS site and upwelling centers as a proxy for foraging areas)
8. Estuaries / coastal marsh (Estuaries and coastal marsh data layers from IMS site)
9. Kelp forests (Kelp records from IMS site, including persistent kelp and available individual years 1989, 1999, 2002, and 2003)
10. Top fish and bird diversity areas (Highest 20% fish and bird density and diversity data layer from IMS site)